

CARBON CAPTURE & SEQUESTRATION

Towards a Berkeley-Stanford Energy Innovation Hub

ENERGY INNOVATION HUBS

25 M\$ for 5 year

- Fuel from Sunshine;
- Batteries and Energy Storage;
- Carbon Capture and Storage;
- Solar Electricity;
- Energy Efficient Building Systems and Design;
- Grid Materials, Devices, and Systems;
- Modeling and Simulation with Nuclear Energy;
- Extreme Materials within Nuclear Energy

CARBON CAPTURE AND STORAGE

Fossil Energy

In FY 2010, the Energy Innovation Hub for Carbon Capture and Storage will focus on enabling fundamental advances and discovery of novel and revolutionary capture/separation approaches leading to transformational capture technologies to dramatically reduce the energy penalty and costs associated with CO₂ capture.

... but this may not be the final text ...

... in the workshop we try to define

SOME ISSUES

- The scale of the CO₂ problem is beyond comprehension
- Innovations have a very long time scale in this industry (20-40 years)

HOW MUCH IS 125M\$

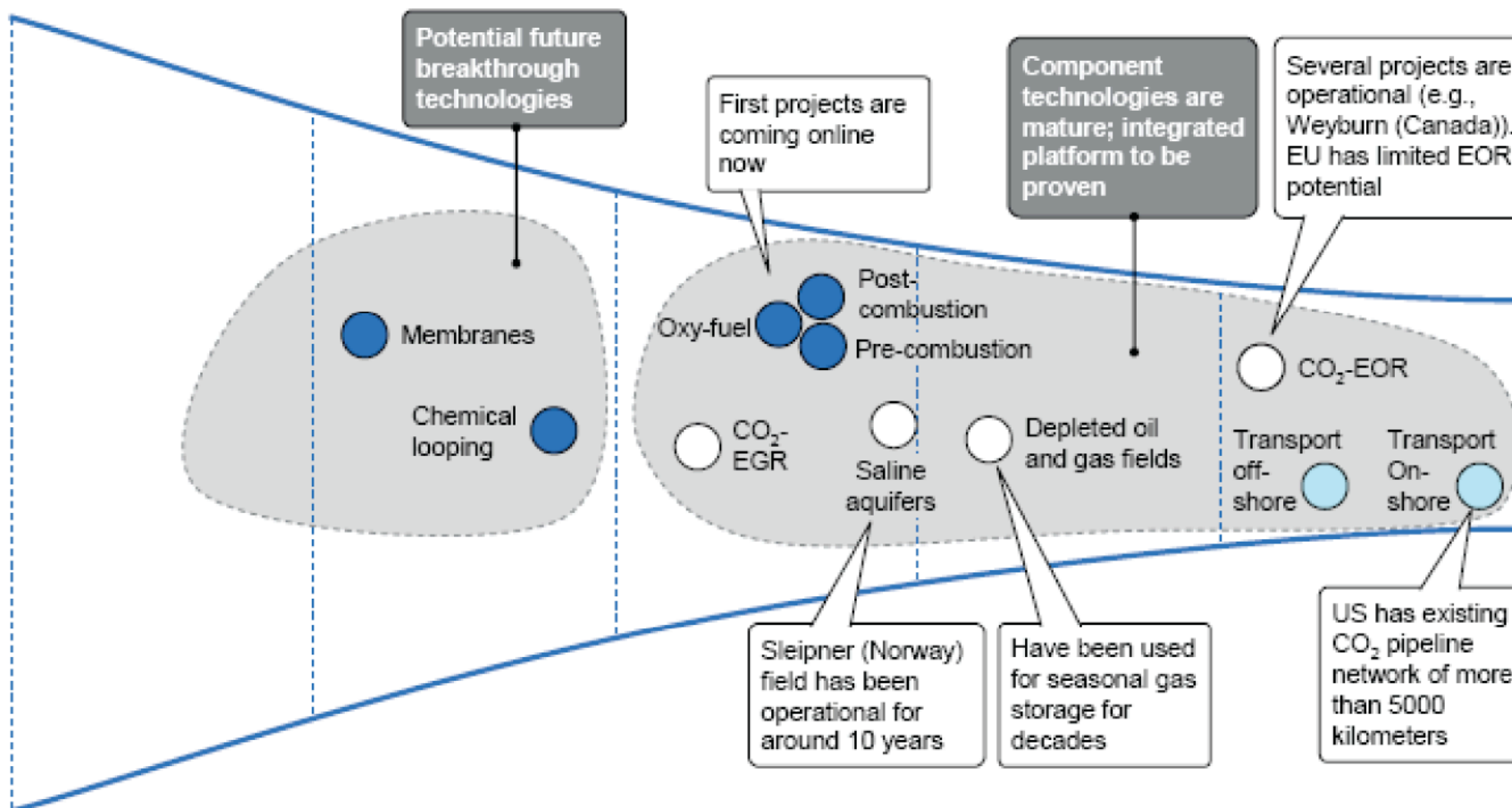
1 Pirates of the Caribbean: At World's End 2007	\$ 300 m
2 Spider-Man 3 2007	\$ 258 m
3 Pirates of the Caribbean: Dead Man's Chest 2006	\$ 225 m
4 X-Men: The Last Stand 2006	\$ 210 m
5 Superman Returns 2006	\$ 209 m
6 King Kong 2005	\$ 207 m
...	
29 Angels & Demons 2009	\$ 150 m

Stage of CCS component technologies

- Capture
- Transport
- Storage

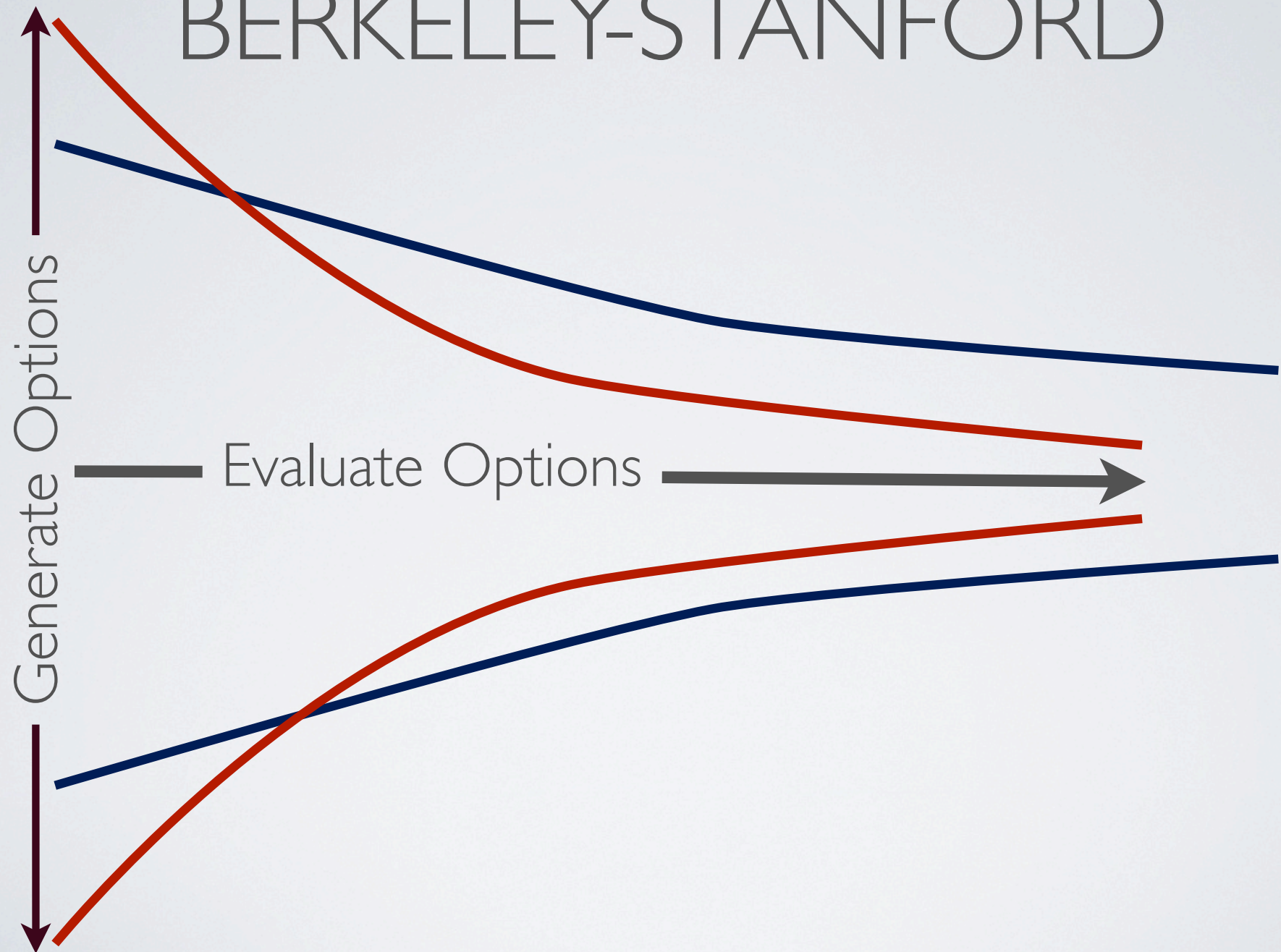
Stage of development

Concept	Lab testing	Demonstration	Commercial refinements needed	Commercial
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Source: Interviews; Team analysis

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AIMS OF THE WORKSHOP

- As there is no call for the Hub; hence there is **no** criteria to argue whether an idea/expertise should be included or not
- Identify the possible strengths of a Berkeley-Stanford collaboration
- If we would write a call for a hub how should it look like?
- There will be **many** opportunities in this field
 - Exchange of information
 - Exchange of expertise

Introduction

9:00 AM *Welcome* – Berend Smit (LBNL/UCB)

9:10 AM *The Challenges for CCS* – Sally Benson (Stanford)

Physical Capture and Sequestration

9:40 AM *Introduction to Energy Frontiers Research Centers at LBNL and UCB*

- Jeff Long (LBNL/UCB) – *Carbon Capture EFRC*
- Don DePaolo (LBNL/UCB) – *Carbon Storage EFRC*

10:00 AM *Brainstorming framed by Short Presentations* (Refreshments Served)

Two-Slide Presentations

- Lou Durlofsky (Stanford) – *Computational Issues for Modeling and Optimizing CO₂ Sequestration*
- Steven Kaye (Wildcat Discovery Technologies) – *High Throughput Gas Separation and Storage Tools*
- Curt Oldenburg (LBNL) – *Some Beneficial Uses of CO₂ in Subsurface Systems*
- Lynn Orr (Stanford) – *Research Issues for Enhanced Oil Recovery and Coal Bed and Basalt Storage*
- Mark Zoback (Stanford) – *A Strategy for Enhanced Recovery and CO₂ Sequestration in Gas Shales*

11:00 AM *Discussion*

The Broader Context of Carbon Capture and Sequestration

11:30 AM *The Scale of the Problem*

- Abhoyjit Bhowan (Electric Power Research Institute)

12:00 PM *Brainstorming framed by Short Presentations* (Lunch Served at 12:30)

Two-Slide Presentations

- Ron Cohen (LBNL/UCB) – *Verification of Greenhouse Gas Emissions Reduction*
- Karl Gerdes (Chevron) – *Industrial Perspective on Cost, Energetics, and Scale*
- Isha Ray (UCB) – *Incorporating Public Perceptions of CCS in Energy Policy*
- Alan Sanstad (LBNL) – *Improving Modeling of Economy, Climate, and Energy Policy to Support CCS R&D*

Chemical Capture and Sequestration

1:30 PM *Overview of Chemical CCS, Stripping, and Utilization*

- Clifford Kubiak (UCSD)

2:00 PM *Brainstorming framed by Short Presentations* (Refreshments Served at 3:00)

Two-Slide Presentations

- Caroline Ajo-Franklin (LBNL)
- John Arnold (UCB) – *Clean oxidation process and chemical feedstocks*
- Chris Edwards (Stanford) – *Coupling energy processing and carbon storage*
- Jon Ellman (LBNL/UCB)
- Heinz Frei (LBNL) – *Conversion to fuel via sunlight*
- Zahid Hussain (LBNL) – *What the Advanced Light Source Can Offer for CCS*
- Jeff Long (LBNL/UCB) – *Catalytic Reduction for CO₂*

Biologically-Inspired Carbon Capture and Sequestration

3:30 PM *Overview of Biological CCS*

- Jan Liphardt (LBNL/UCB)

4:00 PM *Brainstorming framed by Short Presentations*

Two-Slide Presentations

- Terry Hazen (LBNL)
- Christer Jansson (LBNL) – *Algal Cultures for Biofuel, Carbon Capture, and Biosequestration*
- Janet Jansson (LBNL) – *LBNL Efforts on Biosequestration*
- Cheryl Kerfeld (LBNL/JGI) – *Biological Carbon Capture and Fixation in Bacterial Microcompartments*
- John Tainer (LBNL) – *Algal Biosequestration*

Conclusion

4:50 PM *Remarks* – Berend Smit (LBNL/UCB)